Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/503
PORTUGAL
February 1964
Submitted in:
ENGLISH and FRENCH

Confidential until official release during Conference

Abstract

CHEMICAL TREATMENT OF URANIUM ORES AT THE MINES, IN A SEMI-MOBILE PLANT

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In the uraniferous area situated in the north-east of Portugal far away from the only industrial uranium chemical treatment plant existing in the country, a few small dispersed deposits are found, each containing about 10 to 50 t of uranium. The relatively small reserves and the dispersion of the deposits would not justify the building of a conventional plant in that area. For this reason studies were directed to develop an economical process of uranium concentration, involving equipment that might be easily moved from mine to mine.

Studies were carried out with a view to reducing or eliminating bulky operations, such as grinding and liquid-solids separation. The treatment of the ores after a coarse crushing was tried. Bench scale studies were carried out, the two following processes having been tried:

a) The ore was imbibed with a sulphuric acid solution, and after different periods of time was watered to remove soluble uranium.

b) The ore was sprinkled with a sulphuric acid solution, and later was watered to remove soluble uranium.

These two processes were applied with encouraging results to several kinds of ores, with the exception of the alkaline and impermeable ores.

In particular, the treatment of Forte Velho ore, which essentially consists of a weathered granitic rock with torbenite mineralization, was studied in great detail. In the laboratory experiments, from an ore containing 0.2% U_3O_8, ground to minus 1/2", placed in small columns, a recovery of 80% of the uranium was obtained, with an acid consumption lower than 25 kg per ton of ore. The results also suggested the advantages of recirculating the richer acid leach liquors through fresh ores, and of using higher columns in order to increase the contact time between the ore and the acid solution.

Based on these experiments, a 35 t./day pilot plant was designed. The plant comprises essentially:

a) Equipment for crushing the ore to minus 1/2".

b) A set of cells where the ore is stocked, sprinkled and watered.

c) A set of tanks to collect leach liquors and to adjust the pH.

d) Ion exchange columns.

e) Equipment for precipitation and filtration of the concentrate.

This plant has been running since May 1962. The uranium recovery has been about 75% in spite of frequent variations of characteristics and grade of the uranium ores being treated. The uranium concentrate contains about 75% U_3O_8.

Details about the equipment and on operating costs are mentioned. Reference is also made to some problems concerned with the plant operation such as:

a) Behaviour of the ion exchange resins.

b) Attempts to eliminate phosphate interferences in the elution.

c) Treatment of the ores by immersion in a sulphuric acid solution.